Remote Control of the Function Generator

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Introduction

Another instrument which is discussed in the 3rd-Year Specialization Lab is, “Agilent 33220A, 20 MHz Function / Arbitrary Waveform Generator.” As the name implies, Agilent 33220A has the capability of generating built-in standard & arbitrary waveforms and pulses.

The function generator, which we use in the lab, includes 10 standard waveforms (sine, square, ramp, etc.), Built-in 14-bit 50 MSa/s arbitrary waveform generation capability, precise pulse waveform capabilities as well as a waveform storage capacity. It also has the feature of downloading a maximum of 64K-point arbitrary waveform externally. The instrument can be accessed remotely via GPIB (IEEE-488), USB, and LAN remote interfaces, which are compatible with SCPI (Standard Commands for Programmable Instruments).

IP address of the device

The IP address of the device is found under the “utility” menu key. In order to view the IP address, Press “utility” hard key and then press the I/O softkey. Select the “LAN” menu afterwards. Press the LAN softkey. Select “Current Config” soft key and there you will see the IP address. Press “DONE” to exit each menu in turn or press “Utility” hard key to exit the menu directly.

Remote control using MATLAB

Out of 3 interfacing methods, we use LAN for remote controlling purposes of the instrument throughout the lab. Using MATLAB, the remote controlling commands are similar to that of the spectrum analyzer, with slight deviations. Hence, as described under spectrum analyzer, we should first define a TCPIP Visa object (referred to “h”), as given in the following MATLAB command.

```
h = visa('agilent','TCPIP:: ip-address::INSTR')
```

The rest of the program routine is as described under the spectrum analyzer specification.

Important Note: If the connection between the target device is set (with the command fopen(h)), without closing the connection (with the command fclose(h)), and, another connection is set again, this can cause a problem. In this case, MATLAB should be restarted.

Programming commands and syntax

Referring to Chapter 4 of the user-manual of Agilent 33220A, all the SCPI commands can be found, which is needed for remote control programming. Using those commands described under Chapter 4, we can write our MATLAB program to control the function generator, using *fprintf()*.

As an example, just after establishing the connection between the function generator and the PC, it is recommended to reset the function generator, in order to avoid conflicts between the previous settings. In SCPI, the reset command for the function generator is, "`*RST`", and we can pass the reset command to the device using MATLAB by,

"`fprintf(h,'*RST')`" , given that "h" is the visa object.

Similarly, the SCPI command for setting the frequency of the waveform can be expressed as follows.

"`FREQuency {<`*frequency*`>|MINimum|MAXimum}`"

The command syntax shows most commands (and some parameters) as a mixture of upper- and lower-case letters. The upper-case letters indicate the abbreviated spelling for the command. For shorter program lines, you can send the abbreviated form. For better program readability, you can send the long form.

For example, in the above syntax statement, FREQ and FREQUENCY are both acceptable forms. You can use upper- or lower-case letters. Therefore, FREQUENCY, freq, and Freq are all acceptable. Other forms, such as FRE and FREQUEN, will generate an error.

- Braces ({ }) enclose the parameter choices for a given command string. The braces are not sent with the command string.
- A vertical bar (|) separates multiple parameter choices for a given command string.
- Triangle brackets (< >) indicate that you must specify a value for the enclosed parameter. For example, the above syntax statement shows the frequency parameter enclosed in triangle brackets. The brackets are not sent with the command string. You must specify a value for the parameter (such as "FREQ 5000").
- Some parameters are enclosed in square brackets ([ ]). The square brackets indicate that the parameter is optional and can be omitted. The brackets are not sent with the command string. If you do not specify a value for an optional parameter, the function generator chooses a default value.

Finally, in MATLAB, we can use the following command in order to set the frequency, as an example, to 1000Hz.

```
fprintf(h,'FREQuency: 1000')
```

A simple MATLAB program to create a sinusoidal waveform with frequency of 2.5 kHz and 1 V-pp is shown below.

```
h = visa('agilent','TCPIP::10.50.228.107::INSTR');
h.inputbuffersize = 100000;
fopen(h);

fprintf(h,'*RST');%Reset the function generator
fprintf(h,'FUNCtion SINusoid');%Select waveshape
%Other options are SQUare, RAMP, PULSe, NOISe, DC, and USER
fprintf(h,'OUTPut:LOAD 50');%Set the load impedance to 50 Ohms (default)
%May also be INFinity, as when using oscilloscope or DMM
fprintf(h,'FREQuency: 2500');%Set the frequency
fprintf(h,'VOLTage 1');%Set the amplitude to 1 Vpp
fprintf(h,'OUTPut ON');%Turn on the instrument output
fclose(h);
```